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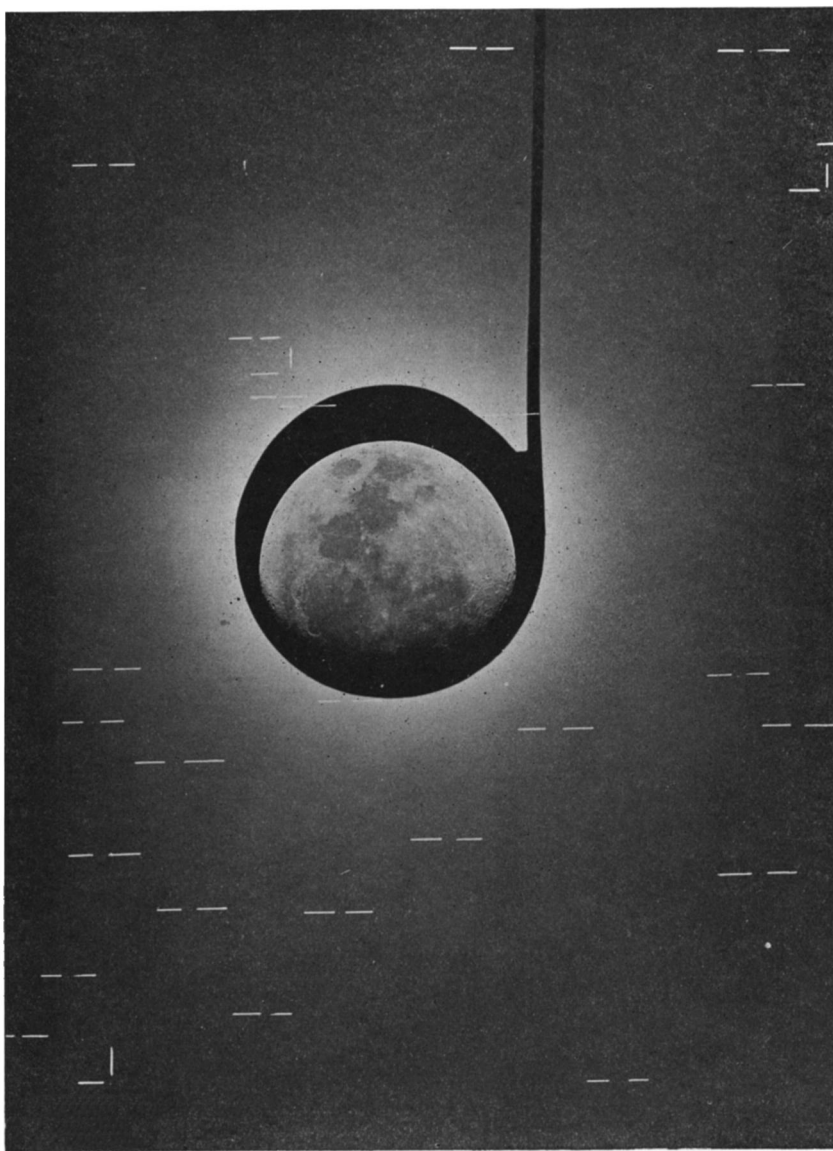
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PHOTOGRAPH OF THE MOON AND SURROUNDING STARS, JULY 22, 1915.

PRELIMINARY NOTE ON THE DETERMINATION
OF THE POSITION OF THE MOON BY
PHOTOGRAPHY.

BY C. E. ADAMS.

The experiments described here were carried out at the Lick Observatory, Mt. Hamilton, California, with the intention of ascertaining if satisfactory photographs could be secured of the Moon and surrounding stars, from which the position of the Moon could be obtained with high accuracy.

The preliminary results are now submitted with the approval of Director W. W. CAMPBELL, to whom my thanks are tendered for the facilities afforded me in carrying out these experiments.

Quite a number of methods have been used in attacking this problem: some of them indirect, such as those of Major HILLS,¹ and of Mr. E. B. H. WADE,² while of the direct ones those of Prof. H. H. TURNER³ and of Prof. H. N. RUSSELL⁴ are the best known. In Prof. TURNER's method the light of the Moon is cut off from the plate by a rectangular focal plane shutter in which there is a narrow straight slit. The shutter is moved across the field at a uniform rate at right angles to the slit. The resulting image of the Moon is elliptical, owing to the motion of the slit. The stars are photographed on the rest of the plate, which is fogged by the moonlight, but the fogging is not enough to prevent accurate measurement.

Prof. RUSSELL uses a very different arrangement: a circular shutter is placed in front of and some distance away from the objective; the shutter is sufficiently large to cut off the whole of the moonlight from the plate and prevents fogging; but it also interferes with the star images which are

¹ *Mon. Not. R. A. S.*, **55**, 80.

² *Mon. Not. R. A. S.*, **66**, 46.

³ *Mon. Not. R. A. S.*, **64**, 19.

⁴ *Harr. Obs. An.*, **72** No. 1 and **76** No. 7.

The illustration shows plate No. 25, July 22, 1915, Moon's age 10d.8, Moon's declination about -27° . Exposure on stars from 16h 42m 41s to 16h 50m 41s and on Moon. from 16h 46m 4s.69 to 16h 46m 41s.02, Mt. Hamilton sidereal time. On the original negative all stars to 0.0 mag. in Cape Phot. D. M. are easily seen, though many are lost in the reproduction. Their positions are indicated thus: i. Three star positions indicated thus: ! —, are found the Cape, Edinburgh and Lick Zodiacal Catalogs (1900.0).

crescent-shaped. The exposure on the Moon is obtained by turning the shutter momentarily on its edge.

The method used here differs from both of these and its essential features may be thus described: A circular shutter was used to cut off the direct light of the Moon from the plate; the shutter was placed just in front of the plate and slightly exceeded the Moon's image in size. An exposure was made on the field surrounding the Moon, with the Moon cut off by the shutter, and in the middle of the exposure the shutter was turned on its edge momentarily, thus giving an image of the Moon. The plate was fogged; but not enuf to prevent stars as faint as 10.0 magnitude being easily measured on a plate taken at full Moon.

The camera, with circular shutter and connections for the chronograph, was rigidly attached to the Crossley Reflector mounting. The lens is a doublet by BRASHEAR, $4\frac{1}{4}$ inches aperture, 15 feet focal length, corrected for wave length 4500A; the rear surface is flat, and the front surface has a convex curve of 74.73 inches radius. The camera box is one foot square and about 15 feet 6 inches long, and it has diaphragms at about 5 feet and 10 feet from the objective. The circular shutter is 2 inches in diameter, and is placed just in front of the center of the plate. The plates used are Seed No. 27, 8 x 10 inches, and as the scale is one inch = 1149'', the plates cover about $2^{\circ} 30'$ in declination and $12^m 45^s$ ($= 3^{\circ} 11'$) in right ascension on the equator.

The image of the Moon is about 1.6 inches in diameter, so that the shutter is large enuf to screen the Moon for an exposure of several minutes. All plates have been taken without guiding. Plates Nos. 27 and 28 are samples of the plates obtained by this method. They were taken on July 24, 1915, when the Moon was nearly full, the exposures were 6 minutes on the stars and 0.28 seconds on the Moon. On these plates five stars are seen, which are given in the Cape Edinburgh and Lick Catalogs (1900) of Zodiacal stars; while many other stars are easily seen ranging in magnitude to 10.0, and measurements can be readily made from them. These plates were exhibited at the meeting of the American Astronomical Society at Berkeley, California, in August, 1915.

The fogging of the plates is much less than was anticipated from the published accounts of experiments on this problem; and this may be due in some measure to the long focal length used (15 feet).

It will be noticed that in this method no interference is made in the optical train, and that in this respect it differs from the Harvard method, where the stellar images are affected by the screen used in front of the objective.

The experiments—which were made at all ages of the Moon—show that satisfactory plates can be secured even at full Moon, and that the fogging is not sufficient to prevent accurate measurement of the plates, provided a lens of long focus is used.

LICK OBSERVATORY, MT. HAMILTON, CAL.,
July 31, 1915.